GSMaP

GLOBAL SATELLITE MAPPING OF PRECIPITATION

JAXA GSMaP & Applications Status

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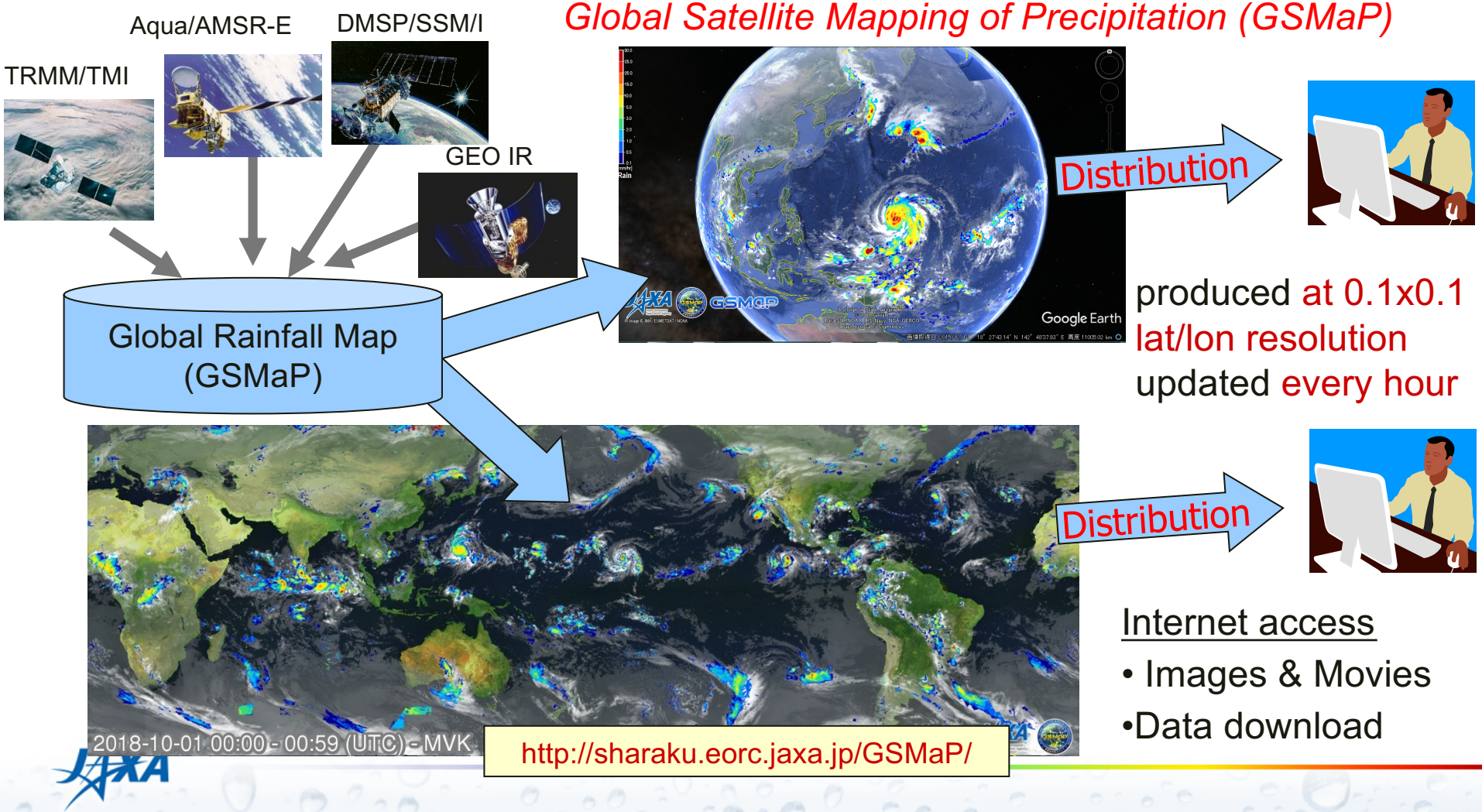
Nov. 2019

Multi-satellite rainfall product by JAXA (GSMaP)

The JAXA has provided hourly global rainfall data (0.1x0.1deg. lat/lon) in near real-time named as the "GSMaP" and visualize the latest data quickly since 2007.

Global Satellite Mapping of Precipitation (GSMaP)



produced at 0.1x0.1 lat/lon resolution updated every hour

Internet access

- Images & Movies
- Data download

GSMaP Product list

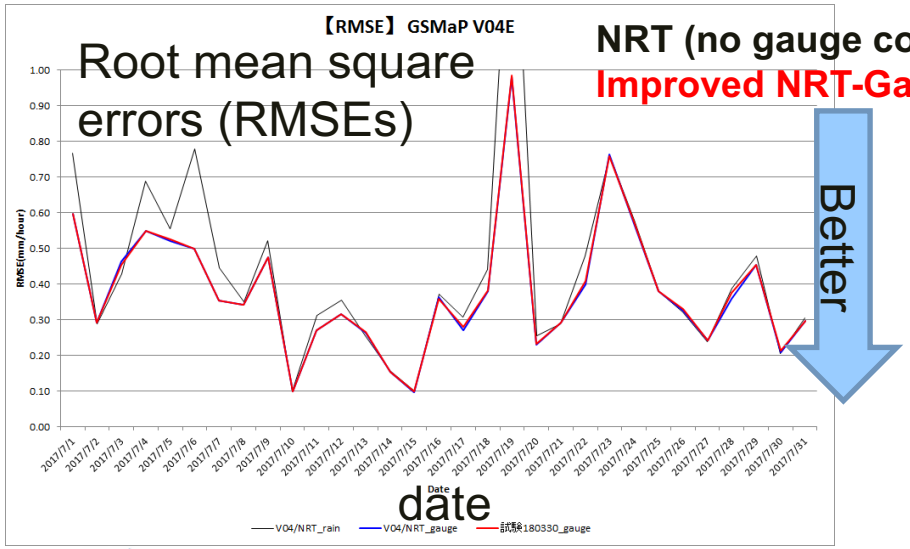
Product name	Variables	Resolution	Latency	Update interval
Standard product	Hourly Precip Rate (**GSMaP_MVK**)	Horizontal: 0.1×0.1 deg.lat/lon Temporal: 1 hour	3 days	1 hour
	Gauge-adjusted Hourly Precip Rate (**GSMaP_Gauge**)			
Near-real-time product	Hourly Precip Rate (**GSMaP_NRT**)		4 hours	
	Gauge-adjusted Hourly Precip Rate (**GSMaP_Gauge_NRT**)			
Real-time product	Hourly Precip Rate (**GSMaP_NOW**):		0 hours	0.5 hour
	Hourly Precip Rate (**GSMaP_Gauge_NOW**):			

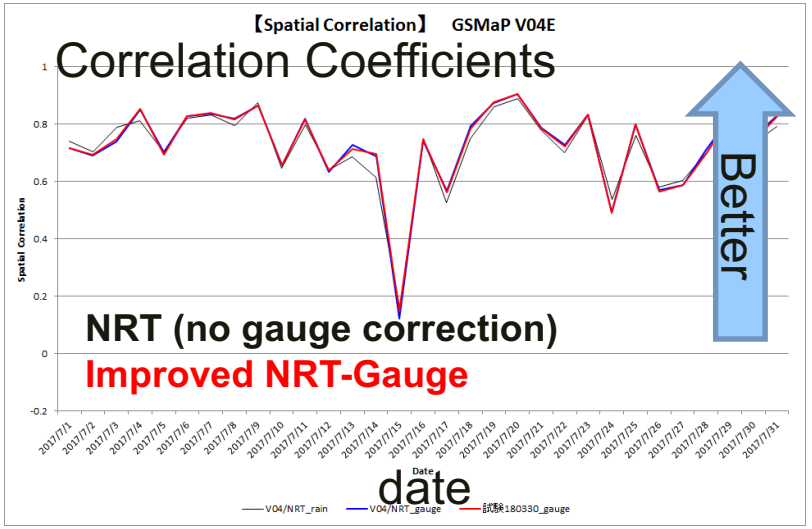
GSMaP uses NOAA/CPC unified rain gauge (2-3 day latency, daily)
FYI. TRMM 3B42 and NASA IMERG final products use GPCC rain gauge(2-3 month latency, monthly).
Note latency, downscaling issues.

A book chapter to review the GPM-era GSMaP products (in the Springer Book on Satellite Precipitation) is in press (Kubota et al. 2019).

Improved NRT-basis Gauge-adjusted GSMaP product (v6)

- Improved NRT-basis Gauge-adjusted GSMaP product (v6) was open to the public in Dec. 2018.
  - Correction coefficients are calculated using past 30 days based upon Mega et al. (2019)'s method.
  - We completed reprocessing of past 19yr data record (since Mar. 2000)
- Validations with reference to the JMA radar around Japan show smaller RMSEs in this new product than the current NRT (no gauge-correction).





Extension of the GSMaP_NOW

Real-time version, GSMaP_NOW has been extended to the whole globe since Jun. 2019!

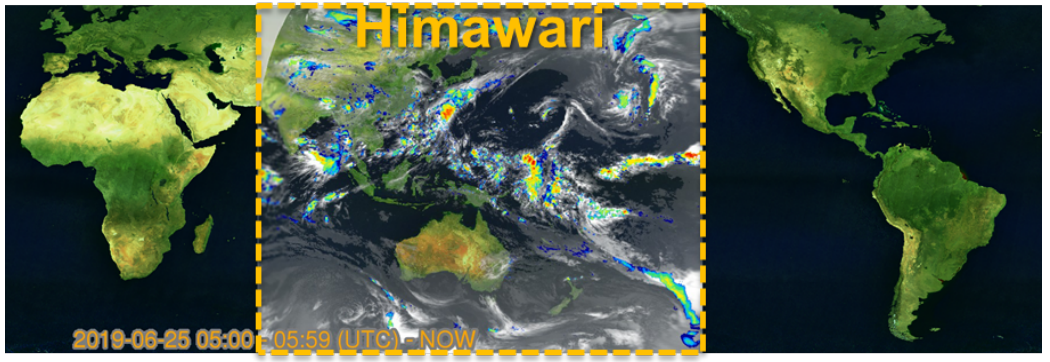
Nov.2015
Open to the public
Within Himawari region

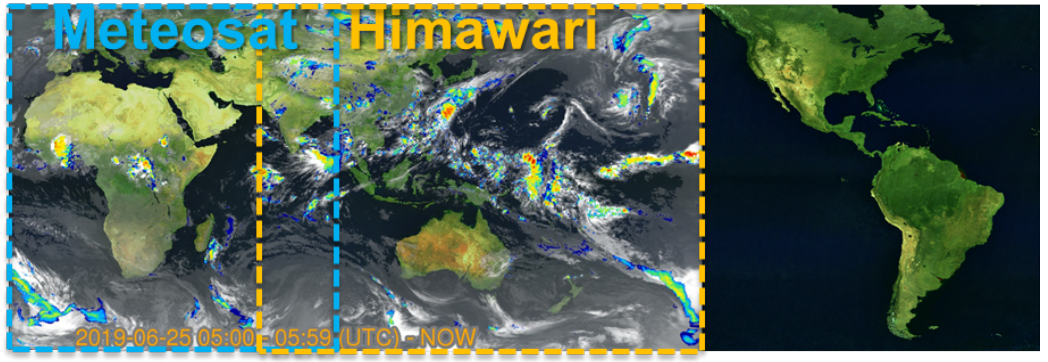
Data collection by the JAXA-EUMETSAT MOU

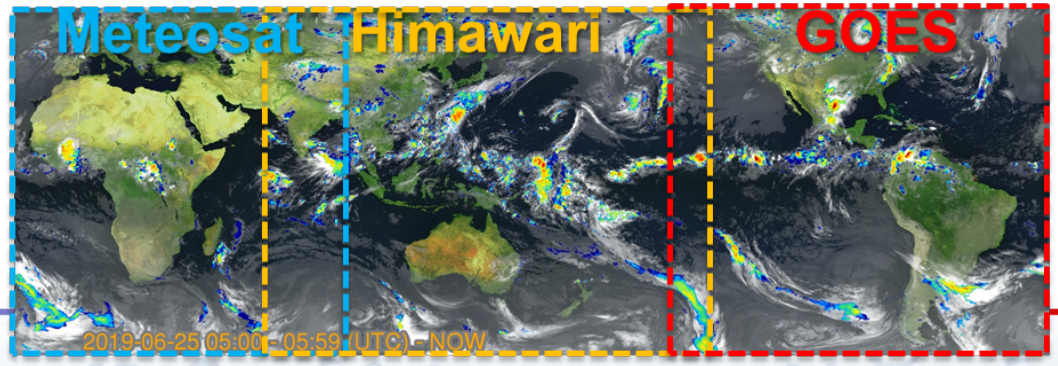
Nov.2018
Extended to Meteosat region

Data collection with the INPE, Chiba Univ. & JMA

Jun.2019
Extended to GOES region
=Whole globe!

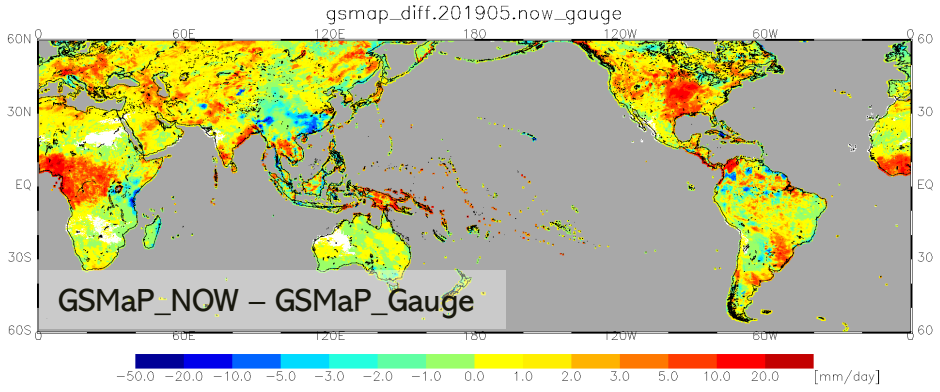


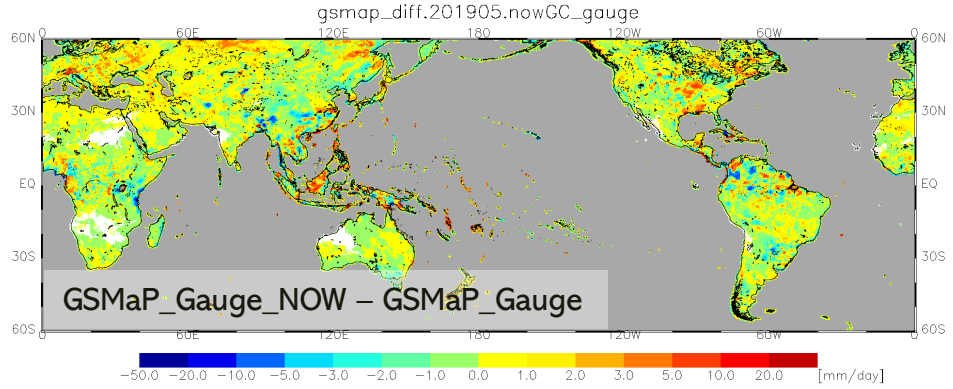




Gauge-adjusted realtime-version

- Some analyses showed the GSMaP_NOW tends to overestimate.
  - The RMSE values of the GSMaP_NOW were sometimes worse than those of the NOAA NESDIS Hydro-Estimater (H-E), while the correlation values of the GSMaP_NOW were better than those of the H-E (Kubota et al. 2019).
- Therefore, we developed the gauge-adjusted realtime version, GSMaP_Gauge_NOW, which was released in June 2019.
  - In the method, estimates from the GSMaP_NOW are adjusted using an optimization model (Mega et al. 2019) with parameters calculated from the GSMaP_Gauge (gauge-adjusted standard version) during the past 30 days.





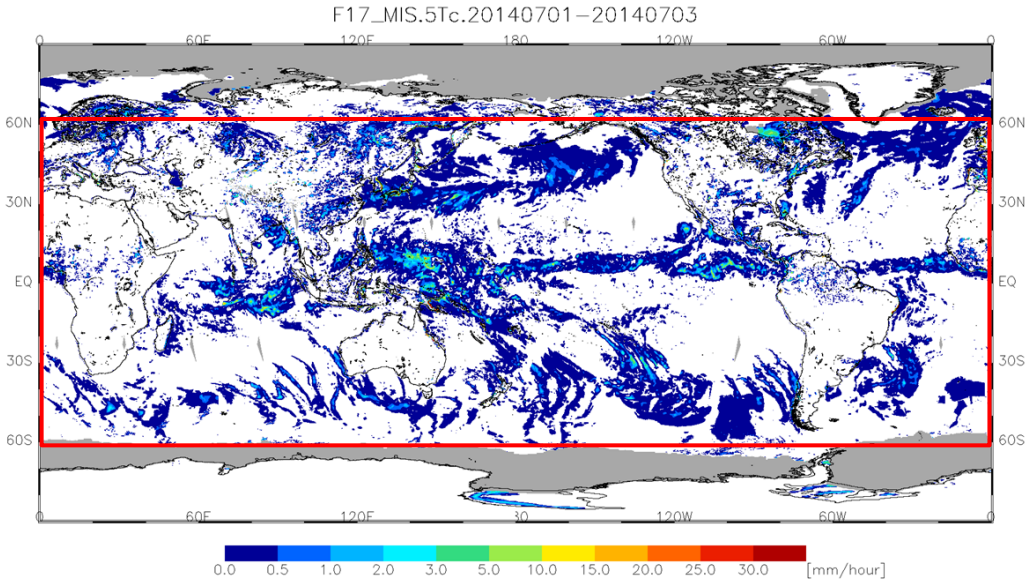
Biases of the GSMaP_NOW was mitigated in the GSMaP_Gauge_NOW.

Future plan: New version in 2020

- **<u>A new version (including reprocessing in past 20 years) will appear in July 2020.</u>**
  - Extend the PMW retrieval domain to the polar region.
  - Improve the GSMaP PMW retrievals.
    - The database using GPM/DPR in the PMW retrievals
    - The scattering algorithm over the land (by Dr. Aonashi)
    - The method for orographic rainfall (by Prof. Shige)
  - Install normalization among the PMW retrievals with the GMI/TMI
  - Improve the gauge-correction method and PMW-IR algorithm (by Prof. Ushio)

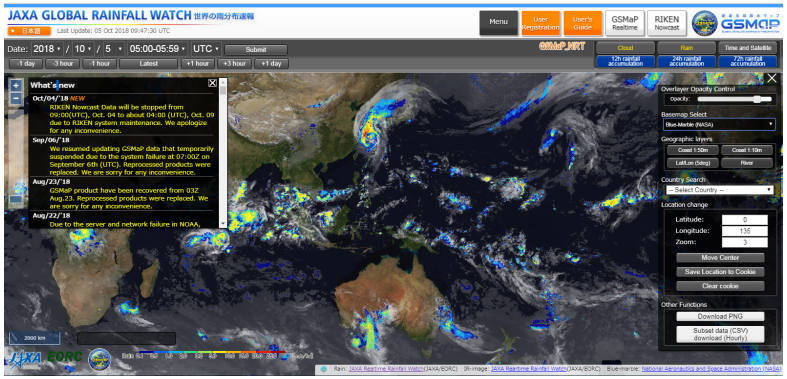
Experimental GSMaP data extended to the higher latitudes
by T. Tashima and T. Kubota
(JAXA/EORC)

Current GSMaP
60N-60S



GSMaP utilization and application

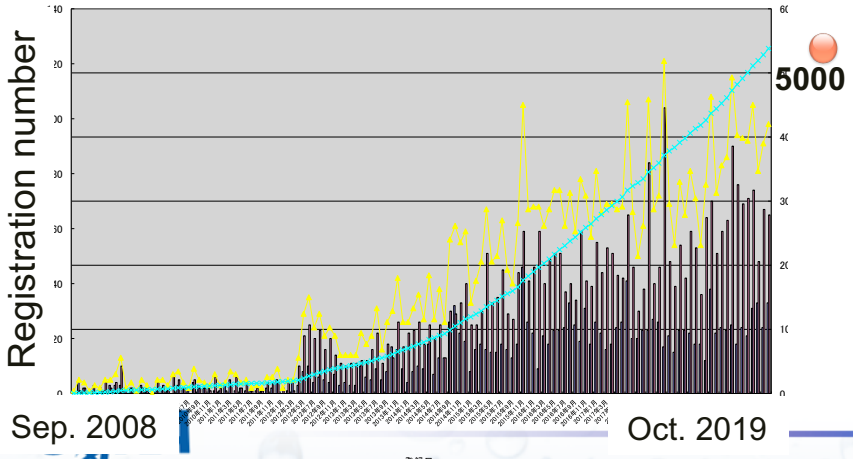
The GSMaP by the JAXA has been used in various applications!



https://sharaku.eorc.jaxa.jp/GSMaP/

5380 registered users from 128 countries
(as of Sep. 2019**)**

GSMaP registered numbers



Weather monitoring

- Meteorological agencies in Asia/Oceania country
- WMO project (SEMDP)
- Weather company (JWA)

Flood warning/prediction

- International Flood Network (IFNet), Infrastructure Development Institute (IDI) : Global Flood Alert System (GFAS)
- International Centre for Water Hazard and Risk Management (ICHARM) : Integrated Flood Analysis System (IFAS)
- UNESCO-IHP: flood warning system using IFAS
- Asia Development Bank (ADB): River management including flood risk
- Japan International Cooperation Agency (JICA)

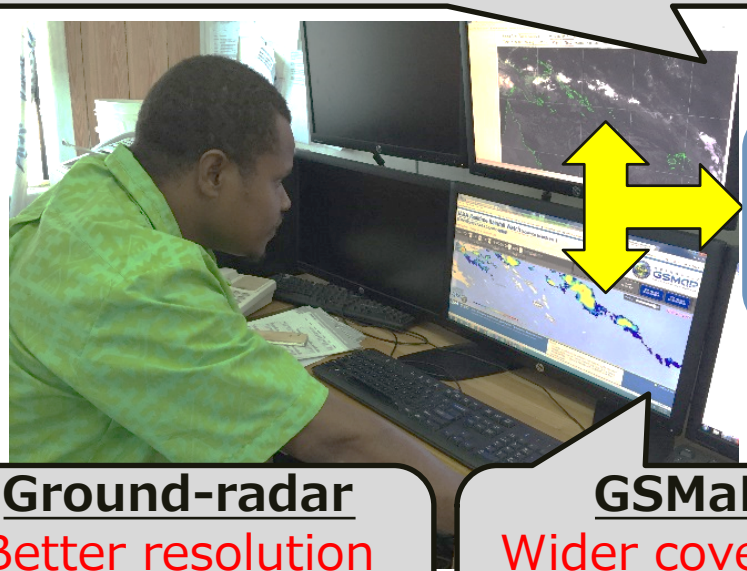
Agriculture

- MAFF (Ministry of Agriculture, Forestry and Fisheries in Japan) for watching crop situation in the world.
- Asia-RiCE (Asia Rice Crop Estimation & Monitoring) for GEO Global Agricultural Monitoring (GEOGLAM)
- Agricultural Insurance

JMA-JAXA Collaboration for the GSMaP started in March 2019 (RSMC Tokyo for Nowcasting)

JAXA and Japan Meteorological Agency (JMA) started a collaboration for the GSMaP for developing regional integrated precipitation product by using ground/space observation in RSMC Tokyo for Nowcasting (https://www.jma.go.jp/jma/jma-eng/jma-center/nowcasting/).

Himawari
Better resolution & wider coverage
but cloud observation
(not directly observing rainfall)

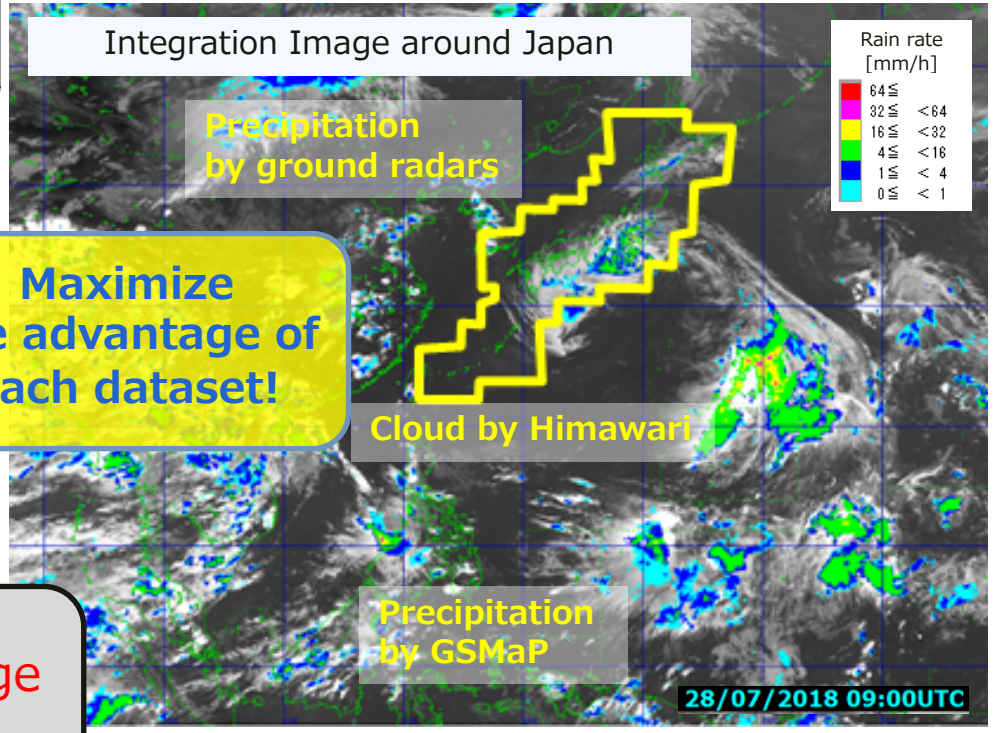


Maximize the advantage of each dataset!

Ground-radar
Better resolution
but limited around the radar site

GSMaP
Wider coverage
but coarse resolution

Effect by "Ground x Space"



Rainfall from GSMaP and ground radars Cloud from Himawari

Utilization in a weather company (JWA)

- The Japanese top-level weather company, Japan Weather Association (JWA) started a home page displaying the GSMaP_NOW and forecasts using the GSMaP_NOW (3-hour nowcasting) on April. 2019 with https://tenki.jp/jaxa/.

Area selection
- Asia/Oceania
- South Asia
- East Asia
- Hawaii
- Oceania

JWA's target is use of Japanese travelers (and so they include "Hawaii").

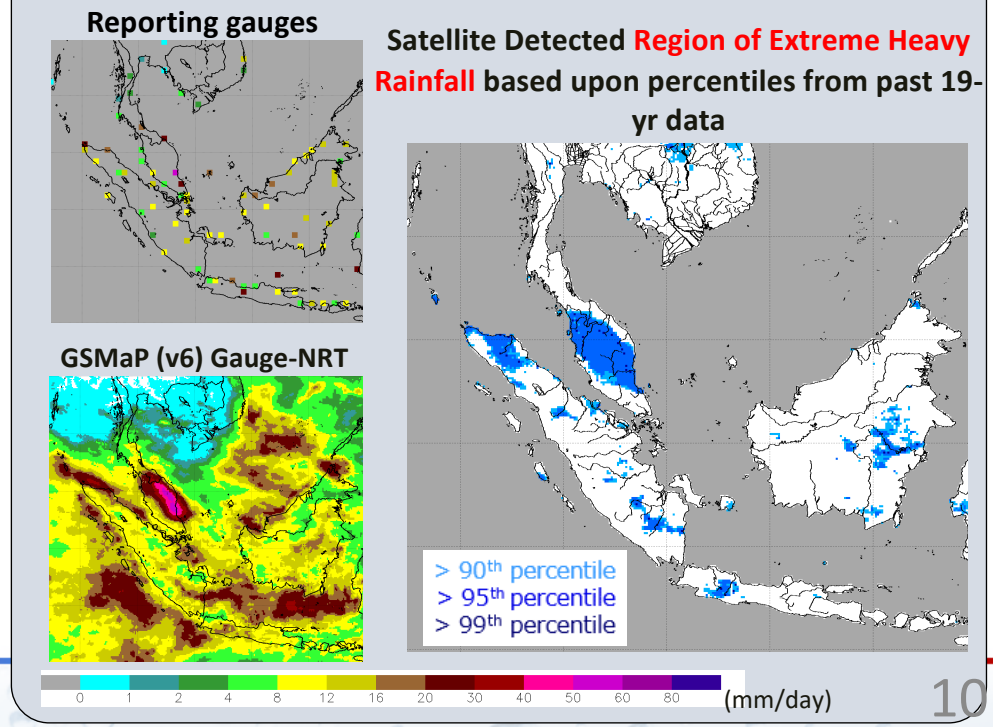
WMO SEMDP

Space-based Weather and Climate Extremes Monitoring Demonstration Project

- WMO Space-based Weather and Climate Extremes Monitoring (SWCEM) Demonstration Project (SEMDP), East Asia and Western Pacific Regional Subproject initiated in 2018 (Kuleshov et al. 2019, DOI:10.5772/intechopen.85824).
- JAXA attends this subproject with the GSMaP, and provide the **GSMaP_Gauge_NRT** product with 19yr-climate normal.
- Targets are **heavy rainfall and drought** from 5-days up to a month.

Eleventh ASEAN Climate Outlook Forum and WMO SEMDP Workshop & Steering Group Meeting
29 October - 2 November 2018
Kuala Lumpur, Malaysia

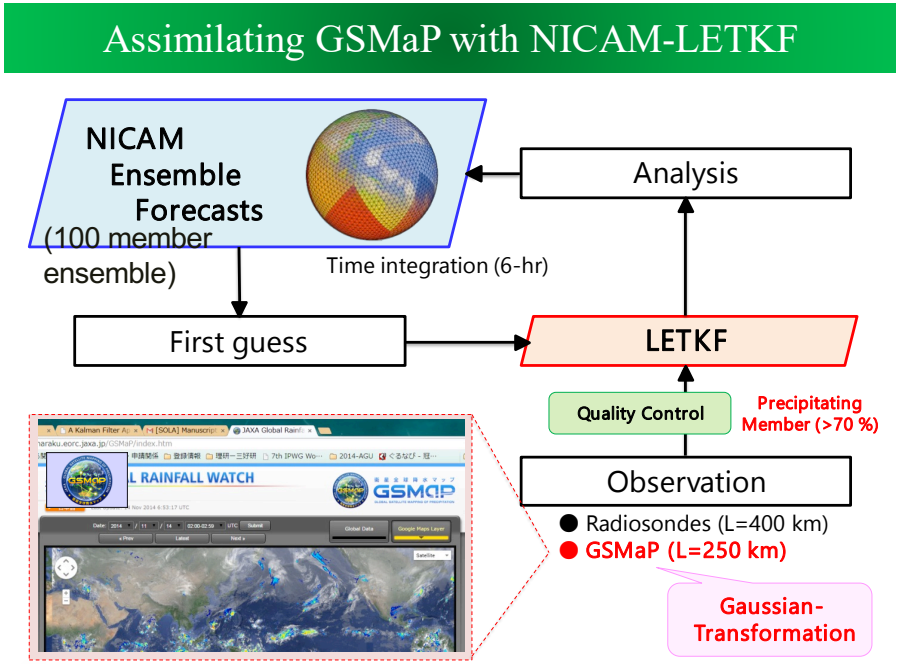
Case study over Indonesia on Dec2014

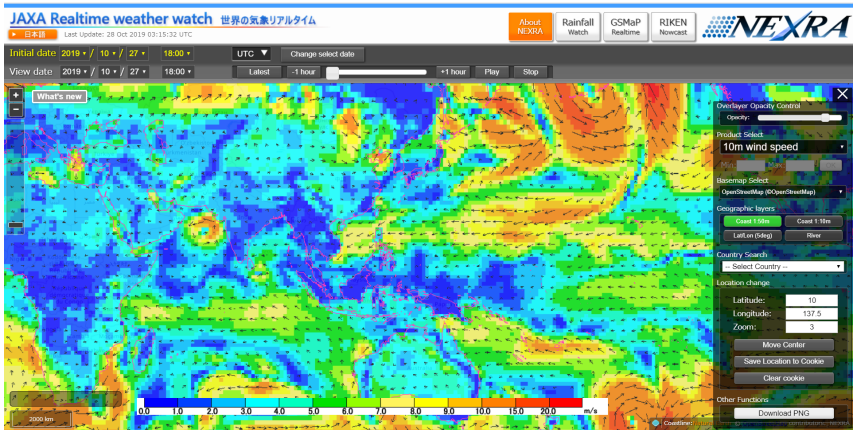


GSMaP assimilation in JAXA supercomputer system (NEXRA)

- JAXA, Univ. Tokyo and RIKEN installed the NICAM-LETKF data assimilation system using the GSMaP at JAXA supercomputer system generation 2 (JSS2) and has experimentally operated it in near-real time (Kotsuki et al. 2019, *SOLA*).

NICAM-LETKF at JAXA Research Analysis=NEXRA



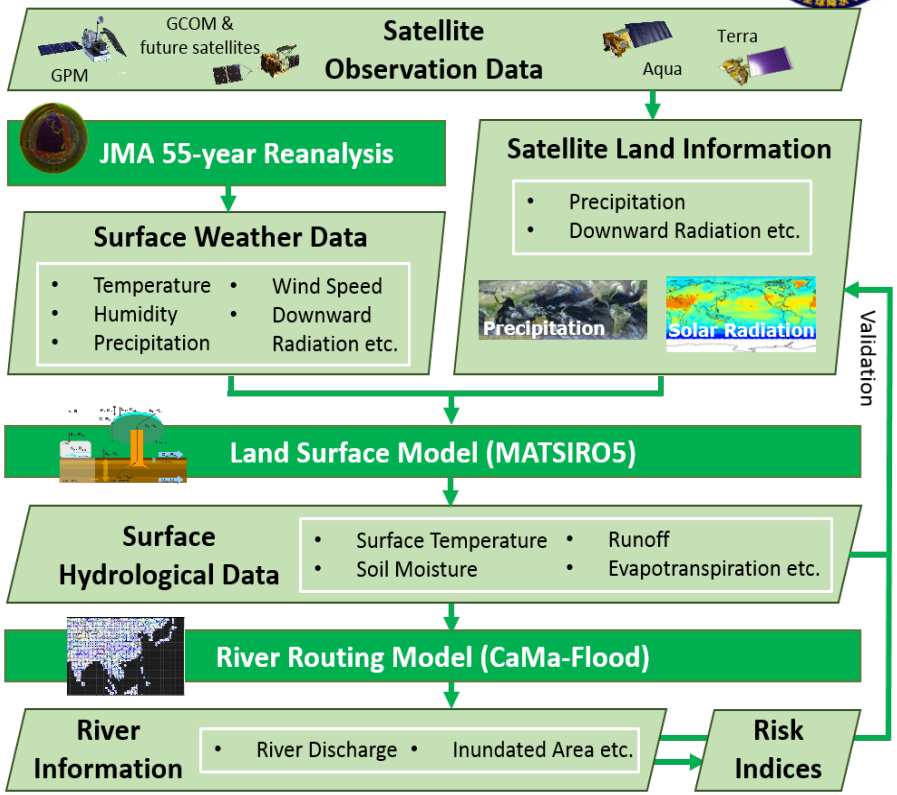


Monitoring home page of the NEXRA is now available as "**JAXA realtime weather watch**".
https://www.eorc.jaxa.jp/theme/NEXRA/

Kotsuki et al., 2019, *SOLA*, 15A, 1-7. doi:10.2151/sola.15A-001

Global Hydrological Simulation System; *Today's Earth (TE)*

- JAXA has developed the global hydrological simulation system "*Today's Earth (TE)*" under the joint research with University of Tokyo.
- Over 50 hydrological variables simulated through 3 different experiments (shown below) are now accessible through the web page and ftp site of the "TE-Global" system.
  https://www.eorc.jaxa.jp/water/

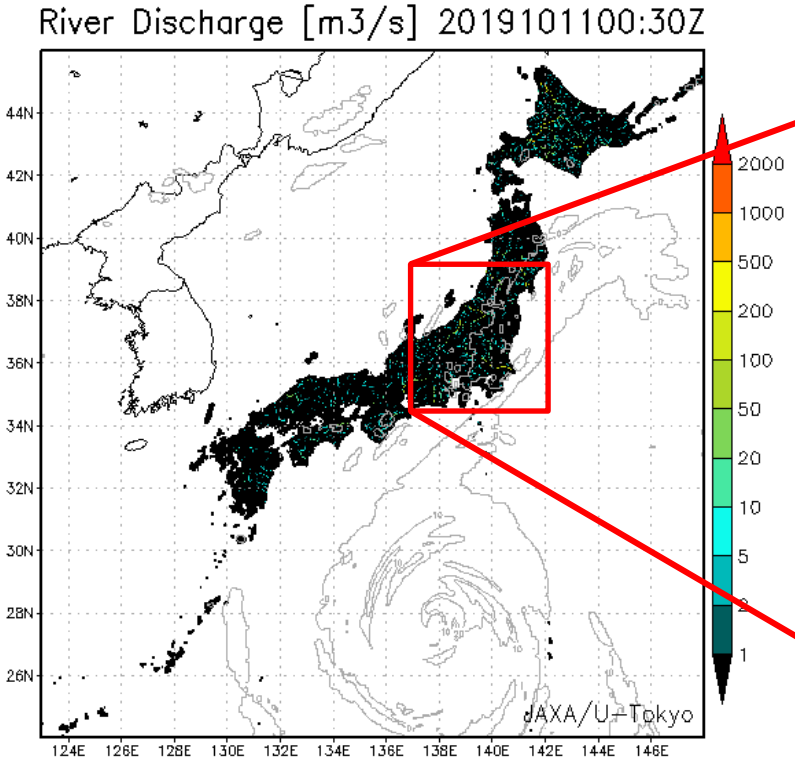


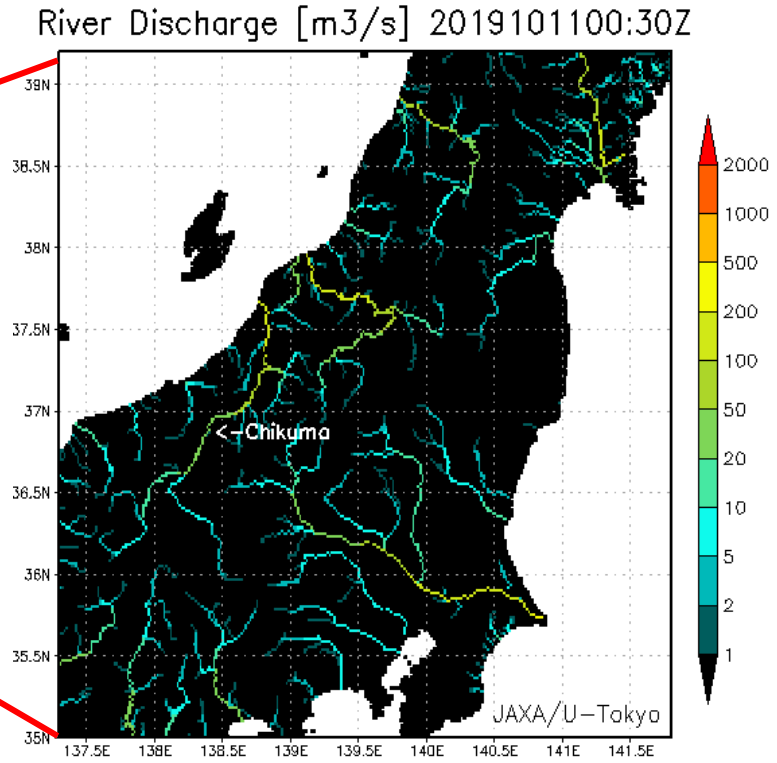
Exp. name	Spatial resol.	Temporal resol.	Period	Latency	Forcing
JRA55 ver.	0.5-deg (land) 0.25-deg (river)	3 hourly, daily, monthly	1958-present	About 3.5 days	JRA55 reanalysis
MODIS ver.	〃	〃	2002-present	About 20 days	JRA55 reanalysis (radiation→MODIS)
GSMaP ver.	〃	〃	2000-present	About 5 days	JRA55 reanalysis (precip.→GSMaP)

TE-Japan simulation for Hagibis

- JAXA and Univ. Tokyo are developing the "TE-Japan" system (High-resolution version of Today's Earth for Japan).
- Devastating flood by typhoon Hagibis (11th Oct. 2019) was reproduced well in this system with the resolution of 1/60 deg.

https://www.eorc.jaxa.jp/water/



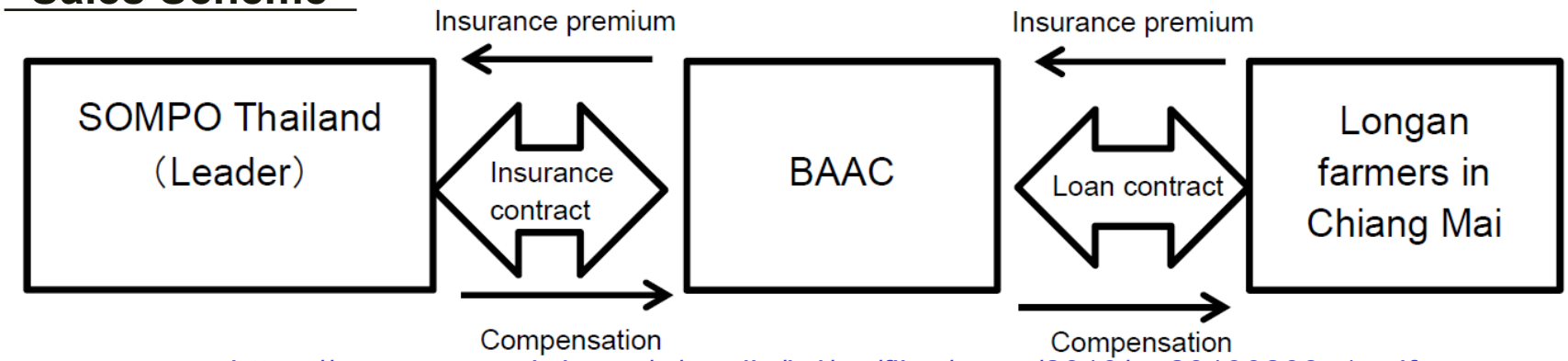


Insurance for Agriculture

- GSMaP-based Weather Index Insurance was developed by Sompo Japan Holdings and Remote Sensing Technology Center of Japan (RESTEC).
  - GSMaP is used to estimate the rainfall amount over the target region where ground-based dataset is insufficient.
  - In February 2019, AgriSompo started to offer “Longan parametric weather insurance program” in Thailand.
  - Longan, the major agricultural export crop for the country, has been exposed to drought risk.
  - The Thai government has been investigating way to launch an efficient financial support program including utilization of insurance to enable stable growth for farmers.

Source:https://sustainabledevelopment.un.org/partnership/?p=30651

<Sales Scheme>



https://www.sompo-hd.com/~/media/hd/en/files/news/2019/e_20190208_1.pdf

GPM Asia-Oceania Workshop (Mar. 2020)

- The 8th GPM Asia-Oceania Workshop on Satellite Precipitation Data Utilization
  - Will be held with Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) in Manila, Philippines, on 12-13 Mar. 2020.
  - (renamed as “GPM Asia Workshop” → “GPM Asia-Oceania Workshop”)
- Purpose of the workshop:
  - To promote satellite precipitation data utilization in Asia-Oceania, and move forward research activities related to GPM in each country in working-level.
  - To share early validation and utilization results of the GPM products in Asia-Oceania countries.
  - To proceed future collaborations between Japan and Asian-Oceania countries.

The 7th GPM Asia Workshop on Satellite Precipitation Data Utilization

Held in Badan Meteorologi, Klimatologi, dan Geofisika (BMKG), Jakarta, Indonesia, on 11-12 Jan. 2018

Summary

- GPM/GSMaP status
  - https://sharaku.eorc.jaxa.jp/GSMaP/index.htm
  - A new version (including reprocessing in past 20 years) will appear in July 2020.
  - Improved NRT-basis Gauge-adjusted GSMaP product (v6) was open to the public in Dec. 2018.
  - GSMaP_NOW was extended to the whole globe on June 2019. The gauge-adjusted realtime version, GSMaP_Gauge_NOW was also release on June 2019.
- Applications status
  - Collaboration with the JMA started in March 2019.
  - JAXA is operating and providing the NEXRA & the TE.
  - Utilization in companies (weather monitoring, insurance)
  - GPM Asia-Oceania Workshop will be held with the PAGASA, Philippine in Mar. 2020.